Amendments to the Claims:

This listing of the claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1-2. **(canceled)**

3. **(original)** The method according to claim 38, wherein the correlation is approximately equal to a ratio of an area of a logical AND between a figure obtained by moving one of the temporally adjacent first figures on the basis of a motion vector thereof and the other of the temporally adjacent first figures to an area of the one or the other of the temporally adjacent first figures.

4-6. **(canceled)**

7. **(original)** The apparatus according to claim 39, wherein the correlation of the step (b) is approximately equal to a ratio of an area of a logical AND between a figure obtained by moving one of the temporally adjacent first figures on the basis of a motion vector thereof and the other of the temporally adjacent first figures to an area of the one or the other of the temporally adjacent first figures.

8-12. **(canceled)**

13. **(currently amended)** A method of tracking moving objects in time-series pictures ~~with~~ by processing the pictures using a processor, each picture being divided into blocks, each block consisting of a plurality of pixels, wherein in a case where an object-identification ~~identification~~ code of moving object is assigned in a unit of block, and a motion vector of moving object is determined in a unit of block, and

wherein object-identification codes of a plurality of moving objects on a picture at a time t1 have been determined, the method, using the processor, comprising the steps of:

~~(a) estimating a motion vector from a block-size region in a picture at a time t1 to a region of interest in a picture at a time t2 as MV, and estimating an identification code of the block of interest as ID;~~

~~(b) determining a correlation-related amount including an absolute value of a difference between the estimated motion vector MV of the block of interest and a motion vector of at least one, having an identification code equal to ID, of blocks surrounding the block of interest in the picture at the time t2; and~~

~~(c) determining a value of an estimation function including the correlation-related amount for each first region moved within a predetermined range, and determining the motion vector MV and the identification code on the basis of an approximately-optimum value of the estimation function.~~

determining each object-identification code and moving vector as approximate values of each of the blocks on a picture at a time t2 on the basis of a first estimation function,

determining a value of a second estimation function using the approximate values; and

determining each object-identification code and moving vector as a solution of each of the blocks on the basis of an approximately-optimum sum of the first and second estimation functions,

wherein the approximately-optimum sum is obtained by changing the approximate values within a given range;

wherein the first estimation function has the sum of a sub-estimation function for determining a moving vector by block matching between a current block on the picture at the time t2 and a region on the picture at the time t1 and a sub-estimation function for determining an object-identification code of the current block on the basis of a count of pixels belonging to the same object-identification code within the region,

wherein the second estimation function includes respective absolute values of differences between the motion vector MV between the current block and the region and a motion vector of each of blocks around the current block, each of the blocks having the same object-identification code as that of the current block, and takes a more optimum value when the sum of the absolute values is smaller.

14. **(currently amended)** The method according to claim 13, wherein ~~the correlation-related amount of the step (c)~~ the second estimation function includes ~~is expressed by~~ $\Sigma|MV-MV_{neighbor}|/L$, where $MV_{neighbor}$ denotes a motion vector of a block having the same object-identification code ~~as the identification code~~ ID of the current block ~~of interest~~, within blocks surrounding the current block ~~of interest~~, Σ denotes a sum over the blocks having said same object-identification code ID, and L denotes a number of the blocks having said same object-identification code ID.

15. **(currently amended)** An apparatus for tracking moving objects in time-series pictures, comprising:

a storage device for storing the time-series pictures and a program;

and a processor coupled to the storage device, wherein the program make the processor read and process the time-series pictures to track the moving objects in the pictures, and by the processing, each picture is divided into blocks, each block consisting of a plurality of pixels, in a case where an object-identification ~~identification~~ code of moving object is assigned in a unit of block, and a motion vector of moving object is determined in a unit of block, and wherein object-identification codes of a plurality of moving objects on a picture at a time t1 has been determined, the program comprising the step of:

~~(a) estimating a motion vector from a block-size region in a picture at a time t1 to a region of interest in a picture at a time t2 as MV, and estimating an identification code of the block of interest as ID;~~

~~(b) determining a correlation-related amount including an absolute value of a difference between the estimated motion vector MV of the block of interest and a motion vector of at least one, having an identification code equal to ID, of blocks surrounding the block of interest in the picture at the time t2; and~~

~~(c) determining a value of an estimation function including the correlation-related amount for each first region moved within a predetermined range, and determining the motion vector MV and the identification code on the basis of an approximately-optimum value of the estimation function.~~

determining each object-identification code and moving vector as approximate values of each of blocks on a picture at a time t2 on the basis of a first

estimation function, and determining a value of a second estimation function using the approximate values;

determining each object-identification code and moving vector as a solution of each of the blocks on the basis of an approximately-optimum sum of the first and second estimation functions, wherein the approximately-optimum sum is obtained by changing the approximate values within a given range;

wherein the first estimation function has the sum of a sub-estimation function for determining a moving vector by block matching between a current block on the picture at the time t2 and a region on the picture at the time t1 and a sub-estimation function for determining an object-identification code of the current block on the basis of a count of pixels belonging to the same object-identification code within the region,

wherein the second estimation function includes respective absolute values of differences between the motion vector MV between the current block and the region and a motion vector of each of blocks around the current block, each of the blocks having the same object-identification code as that of the current block, and takes a more optimum value when the sum of the absolute values is smaller.

16**. (currently amended)** The method according to claim 15, wherein ~~the correlation-related amount of the step (c)~~ the second estimation function includes ~~is expressed by~~ $\Sigma|MV-MV_{neighbor}|/L$, where $MV_{neighbor}$ denotes a motion vector of a block having the same object-identification code ~~as the identification code~~ ID of the current block ~~of interest~~, within blocks surrounding the current block ~~of interest~~, Σ denotes a sum over the blocks having said same object-identification~~identification~~ code ID, and L

denotes a number of the blocks having said same object-identification ~~identification~~ code ID.

17-20. **(canceled)**

21. **(currently amended)** An apparatus for tracking moving objects in time-series pictures, comprising:

a storage device for storing the time-series pictures and a program;

and a processor coupled to the storage device, wherein the program make the processor read and process the time-series pictures to track the moving objects in the pictures, and by the processing, each picture is divided into blocks, each block consisting of a plurality of pixels, the program comprising the step of:

(b1) determining motion vectors of respective blocks in a picture at a time t2 through the use of block matching between a picture at a time t1 and the picture at the time t2, without discriminating between the background image and moving objects;

(b2) determining motion vectors of blocks, which are not determined at the step (b1), by estimating the motion vectors through the use of the method according to any one of ~~claims 9,~~ claims 13 or 14; and

(b3) assigning the same identification code to adjacent blocks if an absolute value of a difference between motion vectors of the adjacent blocks is less than a predetermined value.

22-23. (**canceled)**

24. **(currently amended)** The method according to 42, wherein each of the first and second regions ~~of interest~~ of the step (a) corresponds to one block.

25. **(currently amended)** The method according to 42, wherein the object map of the step (a) is a new object map, and at the step (b), the two regions ~~region of interest is~~ are moved in the negative direction of ~~the~~ their motion ~~vector~~vectors, respectively.

26. **(original)** The method according to 42, wherein the number of the plurality of object maps is kept constant by updating an oldest object map with a newest object map.

27. **(canceled)**

28. **(currently amended)** The method according to ~~claim 27~~ claim 42, wherein, the first region at the time t1 is a single cluster including adjacent blocks and if a plurality of peaks are present in a histogram of absolute values of motion vectors of the blocks ~~for including adjacent blocks having motion vectors~~, an interval between the times t1 and t2 is determined on the basis of a speed difference between the peaks.

29. **(currently amended)** The method according to ~~claim 27~~ claim 42, wherein each time the interval between the times t1 and t2 is increased, it is determined whether or not the absolute value of the difference between the ~~respective~~ first and second fast-forward motion vectors ~~of the two adjacent regions of interest on the object map of the time t2~~ is more than the predetermined value, and wherein if the interval is less than a predetermined maximum value and if the absolute difference is more than the predetermined value, then the ~~two adjacent~~ first and second regions ~~of interest~~ are recognized as different moving objects to each other.

30-31. **(canceled)**

32. **(currently amended)** The method according ~~to 43~~ to claim 42, wherein each of the first and second regions ~~of interest~~ of the step (a) corresponds to one block.

33. **(currently amended)** The method according ~~to 43~~ to claim 42, wherein the object map of the step (a) is a new object map, and at the step (b), the two ~~region~~regions ~~of interest is~~ are moved in the negative direction of ~~the~~ their motion ~~vector~~vectors, respectively.

34. **(currently amended)** The method according ~~to 43~~ to claim 42, wherein the program further comprises the step of:

keeping the number of the plurality of object maps constant by updating an oldest object map with a newest object map.

35. **(canceled)**

36. (**currently amended)** The apparatus according to ~~claim 35~~ claim 43, wherein the first region at the time t1 is a single cluster including adjacent blocks and, wherein the program further comprises the step of:

if a plurality of peaks are present in a histogram of absolute values of motion vectors of the blocks ~~for a single cluster including adjacent blocks having motion vectors~~, determining an interval between the times t1 and t2 on the basis of a speed difference between the peaks.

37. **(currently amended)** The apparatus according to ~~claim 35~~ claim 43, wherein the program further comprises the step of:

each time the interval between the times t1 and t2 is increased, determining whether or not the absolute value of the difference between the ~~respective~~ first and second fast-forward motion vectors ~~of the two adjacent regions of interest on the object map of the time t2~~ is more than the predetermined value; and

if the interval is less than a predetermined maximum value and if the absolute difference is more than the predetermined value, recognizing the ~~two adjacent~~ first and second regions ~~of interest~~ as different moving objects to each other.

38. **(currently amended)** A method of tracking moving objects in time-series pictures ~~with~~ by processing the pictures using a processor, each picture being divided into blocks, each block consisting of a plurality of pixels, wherein in a case where an identification code of moving object is assigned in a unit of block, and a motion vector of moving object is determined in a unit of block, the method being implemented using the processor, comprising the steps of:

(a) for each of N ($N \geq 2$) consecutive pictures within the time-series pictures, assigning the same identification code to adjacent blocks if an absolute value of a difference between motion vectors of the adjacent blocks is less than a predetermined value, thereby allowing different identification codes to be assigned to different moving objects overlapping in a picture;

(b) judging whether or not:

a first object consisting of a group of blocks assigned a first identification code and a second object consisting of a group of blocks assigned a second identification code are in contact with each other in each of the N consecutive pictures;

and a correlation between the first objects in every temporally adjacent pictures in the N consecutive pictures is more than a predetermined value;

(c) tracking the first and second objects backward in time after the judgment of the step (b) is positive.

39. **(original)** An apparatus for tracking moving objects in time-series pictures, comprising:

a storage device for storing the time-series pictures and a program;

and a processor coupled to the storage device, wherein the program make the processor read and process the time-series pictures to track the moving objects in the pictures, and by the processing, each picture is divided into blocks, each block consisting of a plurality of pixels, an identification code of moving object is assigned in a unit of block, and a motion vector of moving object is determined in a unit of block, the program comprising the step of:

(a) for each of N ($N \geq 2$) consecutive pictures within the time-series pictures, assigning the same identification code to adjacent blocks if an absolute value of a difference between motion vectors of the adjacent blocks is less than a predetermined value, thereby allowing different identification codes to be assigned to different moving objects overlapping in a picture;

(b) judging whether or not:

a first object consisting of a group of blocks assigned a first identification code and a second object consisting of a group of blocks assigned a second identification code are in contact with each other in each of the N consecutive pictures;

and a correlation between the first objects in every temporally adjacent pictures in the N consecutive pictures is more than a predetermined value; and

(c) tracking the first and second objects backward in time after the judgment of the step (b) is positive.

40. **(original)** A method according to any one of claims 13 or 14, wherein a background image is regarded as a moving object.

41. **(currently amended)** A method of tracking moving objects in time-series pictures with processing the pictures by a processor, the method, using the processor, comprising the steps of:

(a) dividing each picture into blocks, each block consisting of a plurality of pixels; and

(b) with regarding a background image as a moving object, assigning an identification code of moving object in a unit of block and determining a motion vector of the moving object in a unit of block;

wherein the step (b) comprises the steps of:

(b1) determining motion vectors of respective blocks in a picture at a time t2 through the use of block matching between a picture at a time t1 and the picture at the time t2, without discriminating between the background image and moving objects;

(b2) determining motion vectors of blocks, which are not determined at the step (b1), by estimating the motion vectors through the use of the method according to any one of ~~claims 9,~~ claims 13 or 14; and

(b3) assigning the same identification code to adjacent blocks if an absolute value of a difference between motion vectors of the adjacent blocks is less than a predetermined value.

42. **(currently amended)** A method of tracking a moving object in time-series pictures with processing the pictures by a processor, each picture being divided into blocks, each block consisting of a plurality of pixels, wherein a plurality of object maps of different times have been stored, each object map having motion vectors of the moving object in a unit of block, the method, using the processor, comprising the steps of:

(a) determining ~~a~~ respective motion vectors of ~~a~~ first and second regions adjacent to each other ~~of interest for~~ on one at time t1 of the plurality of object maps; and

(b) determining ~~a~~ respective motion vectors of ~~a~~ two regions , to which the first and second ~~region~~regions ~~of interest is~~ are moved with using the determined motion vectors, respectively, in positive or negative direction thereof, on the basis of an object map at a time corresponding to completion of the movement of the ~~region~~regions,

wherein ~~the moved region is set as a region of interest on the object map of the time corresponding to the completion of the movement of the region, and~~ the step (b) is repeated a plurality of times to track until a time t2 the two ~~region~~regions corresponding to the first and second regions, ~~of interest,~~

wherein at the step (a) or the step (b), for each current region of the two regions, a weighted motion vector average is determined as a motion vector of the

region ~~of interest~~ with using motion vectors of blocks overlapping with the current region ~~of interest~~, where weights given to the respective motion vectors correspond to the number of pixels of respective portions overlapping between the respective blocks and the current region, ~~of interest.~~

the method, using the processor, further comprising the steps of:

obtaining a motion vector from the first region at the time t1 to the corresponding region at the time t2 as a first fast-forward motion vector by accumulating corresponding motion vectors between the times t1 and t2, obtaining a motion vector from the second region at the time t1 to the corresponding region at the time t2 as a second fast-forward motion vector by accumulating corresponding motion vectors between the times t1 and t2; and

recognizing the first and second regions at the time t1 as different moving objects if an absolute value of the difference between the first and second fast-forward motion vectors is more than a predetermined value.

43. **(currently amended)** An apparatus for tracking moving objects in time-series pictures, comprising:

a storage device for storing the time-series pictures and a program;

and a processor coupled to the storage device, wherein the program make the processor read and process the time-series pictures to track the moving objects in the pictures, and by the processing, each picture is divided into blocks, each block consisting of a plurality of pixels, a plurality of object maps of different times have been

stored, each object map having motion vectors of the moving object in a unit of block, the program comprising the step of:

(a) ~~determining a~~ determining respective motion ~~vector~~vectors ~~of a~~ of first and second ~~region~~regions adjacent to each other ~~of interest for~~ on one at time t1 of the plurality of object maps; and

(b) ~~determining a~~ determining respective motion ~~vector~~vectors ~~of a~~ of two ~~region~~regions, to which the first and second ~~region~~regions ~~of interest is~~ are moved with using the determined motion ~~vector~~vectors, respectively, in positive or negative direction thereof, on the basis of an object map at a time corresponding to completion of the movement of the ~~region~~regions,

wherein ~~the moved region is set as a region of interest on the object map of the time corresponding to the completion of the movement of the region, and~~ the step (b) is repeated a plurality of times to track until a time t2 the two ~~region~~regions corresponding to the first and second regions, ~~of interest,~~

wherein at the step (a) or the step (b), for each current region of the two regions, a weighted motion vector average is determined as a motion vector of the region ~~of interest~~ with using motion vectors of blocks overlapping with the current region ~~of interest~~, where weights given to the respective motion vectors correspond to the number of pixels of respective portions overlapping between the respective blocks and the current region, ~~of interest.~~

the program further comprising the steps of:

obtaining a motion vector from the first region at the time t1 to the corresponding region at the time t2 as a first fast-forward motion vector by accumulating corresponding motion vectors between the times t1 and t2, obtaining a motion vector from the second region at the time t1 to the corresponding region at the time t2 as a second fast-forward motion vector by accumulating corresponding motion vectors between the times t1 and t2; and

recognizing the first and second regions at the time t1 as different moving objects if an absolute value of the difference between the first and second fast-forward motion vectors is more than a predetermined value.